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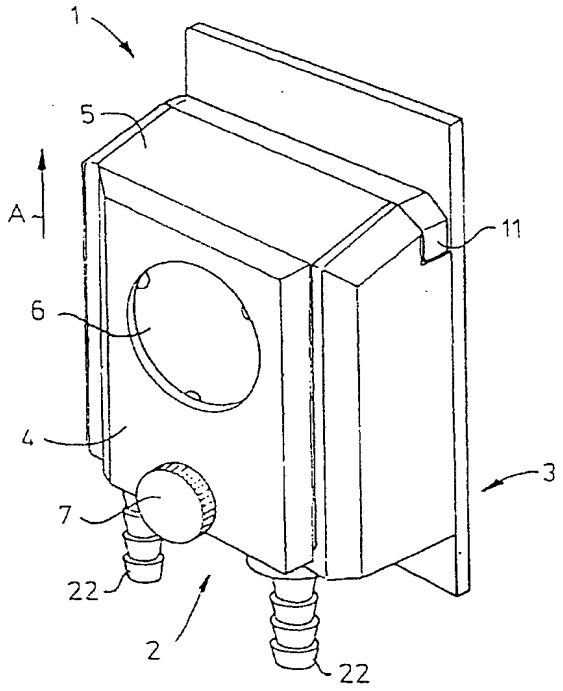
(54) Peristaltic pump

(57) Peristaltic pump having a housing provided with a channel with flexible walls, provided between a propulsion element and a arresting element, said arresting element can be a propulsion element as well, the propulsion element and the arresting element are shaped and co operate with the channel such that a flow of the fluid contained in the channel is generated, the arresting element and/or the propulsion element are designed such that they can be moved from each other for release of said channel, such that said channel can be removed from between said propulsion element and said arresting element.

fig-1



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Description

The invention is concerned with a peristaltic pump according to the preamble of claim 1.

Many peristaltic pumps are known for generating a fluid flow in a channel, commonly a hose of rubber or equivalent, without any propulsion element, apart from the channel wall, directly contacting the fluid to be propulsed. Therefore, the channel is periodically compressed or squeezed between propulsion elements and arresting elements and released to return to its initial shape, such that a "peristaltic" movement of the channel wall is generated and the fluid within the channel is therewith propulsed.

The known peristaltic pump has difficulties in maintenance or repair. It is difficult for the known peristaltic pump to be controlled for its proper functioning. Parts of the known peristaltic pump will wear relatively fast. Furthermore, the known peristaltic pump is assembled from relatively many parts, yielding an expensive production.

It is the object of the present invention, to provide an improved peristaltic pump.

Therefore, a peristaltic pump is proposed according to the combination of features of claim 1. The dependant claims are directed to preferred embodiments.

In the first place, the invention provides for ease of removing or installing the channel (typically a rubber hose or equivalent) from or into the peristaltic pump. For e.g. medical appliances, the costs of e.g. maintenance and repair can be lowered dramatically. For such purpose, the hose must be replaced/cleaned (desinfected) frequently, in view of the high demands for leak tightness and hygiene, while peristaltic pumps are widely applied in the field of medicine, e.g. for kidney dialysis purposes, but for e.g. enterale or parental administration as well. Based on coststs and environemental effects there is a demand for a re-usable peristaltic pump with only a minimum number, preferable none at all, parts that must be replaced for re-use. For other fields of application outside medicine, the invention has important advantages because of the simple replaceability of the hose, too. It further brings an advantage to the producer in assembling the peristaltic pump according to the invention.

The presence of the window gives the opportunity, to monitor the proper function of the peristaltic pump.

By integrating the arresting element in the housing, a further production advantage is achieved, while it is further prevented, compared to an embodiment with a seperate part, that it can't be lost, e.g. during maintenance or repair. In this way, it is not difficult to reliably adjust the distance between the propulsion element and the arresting element, that can be achieved in an automatic manner if the housing is closed, ready for use. Conveniently, the housing can be made from only two seperate parts, which shows advantages for its fabrication. If the seperate components of the housing can be made matching or fitting by sliding them into each other, the release of the pump channel from between the propulsion element and the arresting element for its replacement can be achieved too. For that purpose those seperate parts of the housing can be designed such that they slidingly match with tongue and groove, or they are designed with means equivalent to tongue and groove to achieve the same sliding engagement. For the purpose of lubrication between the propulsion element and the pump channel (the hose), its is further advantageous, to provide the peristaltic pump with a lubricating element making sliding or rubbing contact with the propulsion element. In this way the propulsion element is continuously lubricated, such that there is a continuous lubrication between the hose and the propulsion element, dramatically decreasing ageing (wear). Even if with the known peristaltic pump the propulsion element contains one or more free rotating rolls, engageing the hose, there is still substantial wear due to improper (garanteed over time) lubrication between the propulsion element and the pump channel.

By providing one of the slidingly engageing components of the housing with projecting cams, engageing into corresponding recesses in the other component of the housing, a reliable mutual positional locking can be achieved, requiring only a minimum number of additional components (screws, nuts, bolts, snapping tongues, etc.) to mutually attach the housing parts, preferably easily, detachable. With those cams, engageing into recesses, a reliable arresting means can be provided as well, to reliably and accurately and reproducably adjust the necessary spacing between the propulsion element and the arresting element for a proper functioning of the peristaltic pump, without requiring cumbrous adjustment procedures for the peristaltic pump. A very attractive appearance of the peristaltic pump can be achieved with slidingly engageing housing parts as well.

The invention will further be discussed with reference to a non-limiting embodiment as shown in the accompanying drawings. In the drawings is:

Fig. 1 a perspective view of the peristaltic pump according to the invention;

Fig. 2 a perspective view, viewed from the back, of a first housing part of the peristaltic pump of fig. 1; and

Fig. 3 a perspective view, from the same angle of view of fig. 1, of a second housing part of the peristaltic pump with additional parts, contained therein.

The peristaltic pump 1 of fig. 1 is assembled from two seperate housing parts 2, 3, that are shown more in detail in fig. 2 and 3 respectively. The housing part 2 substantially makes the front wall 4 and the upper wall 5 of the housing 1. The housing part 2 has in its front wall 4 a window 6, such that the inside of the housing can be viewed. The front wall 4 of the housing part 2 furthermore has a bolt 7 at its lower side, to threadingly attach the front wall 4 to the lower wall 8 of the second

housing part 3 (threaded hole 9). For that purpose, the bolt 7 projects into a hole 10 in the front wall 4. At its upper wall 5 this first housing part 2 furthermore carries two cams 11 projecting from both sides, the prupose of which will be clarified further. Apart from those cams 11, this first housing part 2 is designed smaller than the second housing part 3. The first housing part 2 furthermore has two opposing "false" side walls 12, that will be covered substantially completely by the "real" opposing side walls 13 of the second housing part 3, when both housing parts 2, 3 are assembled. Inside, the walls 12 define an arcurate part 14, which functions as arresting element, as exemplified further. Finally, the front wall 4 of the first housing part 2 carries at its lower edge a lip 15, projecting inside from the front wall 4, the function of which will be discussed further.

The second housing part 3 further comprises a supporting plate 16 e.g. for mounting the peristaltic pump 1. The second housing part 3 contains a rotation-element 17. It is assembled from two spaced discs 18 (only one of which is visible) of about the same diameter, provided coaxially and driven in rotation w.r.t. their axis of rotation, and in between three rollers 19. These rollers 19 are provided equally spaced at the circumference of the discs 18, and are all free rotating around a bearing pin 20, the ends of which are supported by the circumference of the discs 18. Each roller 19 projects a little bit beyond the discs 18, as illustrated. Around the rotation element 17, and in contact with at least one of the rollers 19 each time, a hose 21 is provided in an open loop shape. This hose 21 is hollow and made from rubbery or similar, elastic yielding material. The ends of the hose 21 are connected to a feed and exhaust pipe 22, respectively. As is shown in fig. 3, the hose 21, but the rotation element 17 as well, is easily accessible if the first housing part 2 is removed. Immediately below the rotation element 17 a labricating surface 23 is provided. This lubricating surface 23 projects from the supporting plate 16 into the housing. The lubricating surface 23 has a convenient cover (not shown) release a lubricant. The arrangement is such that each time the lubricating surface 23 is in sliding or rubbing engagement with a passing roller 19, such that each time a little bit of lubricant will be transferred from the lubricating surface 23 to the respective passing roller 19. The lubricating surface can be convenient for simultaniously removing debris from the respective roller 19 as well. Below the lubricating surface 23 and below the threaded hole 9 the lower wall 8 of the second housing part 3 has a step or shoulder 24. Said step or shoulder 24 is such that the lip 15 of the first housing part engages therein when assembled according to figure 1. At the upper side, i.e. at the side opposing the step, a recess 25 is provided in both opposing side walls 13, adjacent the supporting plate 16, for receiving a cam 11 (viz. fig. 1). Each recess 25 is open towards the top in the direction parallel to the surface containing the hose 21. In other terms, the recesses are opened in a direction in which the first housing part 2 can be slid out of the second housing part 3 (viz. arrow A in fig. 1).

When the both housing parts 2, 3 are matching (fig. 1), the first housing part 2 with the cams 11, the lip 15 and the bolt 7, is fixed w.r.t. the second housing part 3. By unscrewing the bolt 7, the lower side of the front wall 4 can be pulled slightly forward, such that the lip 15 is released from the step 24. Then the first housing part 2 can slide in the direction of arrow A (fig. 1) w.r.t. the second housing part 3, such that the cams 11 are freed from the respective recesses 25, and after that the housing part 2 can be completely removed. The "false" walls 12 closely fit between the side walls 13 and provide therewith a reliable and accurate slide guide. At the same time said "false" side walls 12 provide an arresting element for the hose 21 with their inner side 14. The hose 21 is therewith confined between the rotation element 17 and the inner side 14 of said side walls 12. The hose is frequently pressed against the inner side 14 by the rollers 19, providing for the necessary "peristaltic" pump movement. By the mutual accurate and reliable guiding of the walls 12 and 13, and by the arresting function between the cams 11 and the recesses 25, without cumbersome adjustment, the convenient spacing between the rotation element 17 and the arresting element 14 (the inner side of the walls 12), and therewith the convenient confinement of the hose 21 can be achieved. After opening the housing by removing the housing part 2, the hose 21 can easily be disengaged from the pipes 22, and subsequently can be removed in radial direction w.r.t. the rotation element 17. For a further accurate guidance, the walls 12 and 13 can be provided with a tongue and groove assembly at their respective, facing surfaces, to achieve an arresting sliding engagement. In that situation, based on fig. 1, the side wall 4 at its lower edge, after removing the bolt 7, can not be pulled slightly outw ard from the housing to release the lip 15 from the step 24. In that situation the lip 15 is a snapping tongue and the bolt 7 might be eliminated. Said lip 15 could be disengaged from the step 24 by use of a seperate tool. Since the front wall 4 extends beyond the "false" side walls 2 at its lower edge, the front wall 4 slightly covers the lower wall 8 (viz. fig. 1), and that is advantageous for an attractive appearance of the housing. It is also advantageous for an attractive appearance of the housing if the front wall 4 is substantially narrower than the widthwise dimension provided by the outer sides of the opposing side walls 13 and said side walls 13, or further components connected thereto, make a part of the front wall 4 but also the upper wall 5 as well, e.g. with attractive facet shape 26, moulded in correspondence with the shape of the cams 11.

Claims

1. Peristaltic pump having a housing provided with a channel with flexible walls, provided between a pro-

pulsion element and a arresting element, said arresting element can be a propulsion element as well, the propulsion element and the arresting element are shaped and co operate with the channel such that a flow of the fluid contained in the channel is generated, characterised in that the arresting element and/or the propulsion element are designed such that they can be moved from each other for release of said channel, such that said channel can be removed from between said propulsion element and said arresting element.

2. Peristaltic pump according to claim 1, wherein the arresting element is part of the housing wall.

3. Peristaltic pump according to claim 1 or 2, wherein the spacing between the arresting element and the propulsion element can be substantially adjusted in the radial direction to remove said channel from said propulsion element and said arresting element in a direction substantially perpendicular to said radial direction .

4. Peristaltic pump according to any of the preceeding claims, wherein said arresting element is part of two mutually crosswise positioned wall elements, at least one wall element is slidingly guided w.r.t. the housing.

5. Peristaltic pump according to claim 4, wherein said wall elements delimit an upper or lower respectively a side wall of said housing and said upper or lower wall is slidingly guided w.r.t. further side walls of said housing.

6. Peristaltic pump according to any of the preceeding claims, wherein said channel is provided in an open loop around said propulsion element, and is contained in a plane substantially parallel to the direction in which the distance between the propulsion element and the arresting element is adjustable.

7. Peristaltic pump according to any of the preceeding claims, wherein one of the walls of the housing has a window to view the propulsion element.

8. Peristaltic pump according to any of the preceeding claims, wherein the propulsion element is slidingly or rubbingly contacting a lubricating element, for lubricated contact between the propulsion element and the channel.

9. Peristaltic pump according to any of the preceeding claims, wherein the housing is assembled from two seperate parts, that can slidingly engage by virtue of tongue and groove connections, the one housing part carries the propulsion element and the channel, the other housing part carries the arresting element, and said housing parts are guided slidingly matching substantially parallel to the direction in which the spacing between the arresting element and the propulsion element is adjustable.

10. Peristaltic pump according to claim 9, wherein, considered in the direction in which the housing parts can slide, one of the housing parts is designed smaller and has locally sideward projecting arresting elements at one or both sides, each projection is adapted for engagement into a respective recess in the other housing part, which respective recess is open in a direction parallel to the plane in which the housing parts can slide, and in a perpendicular direction said recess is not open.

Fig-1

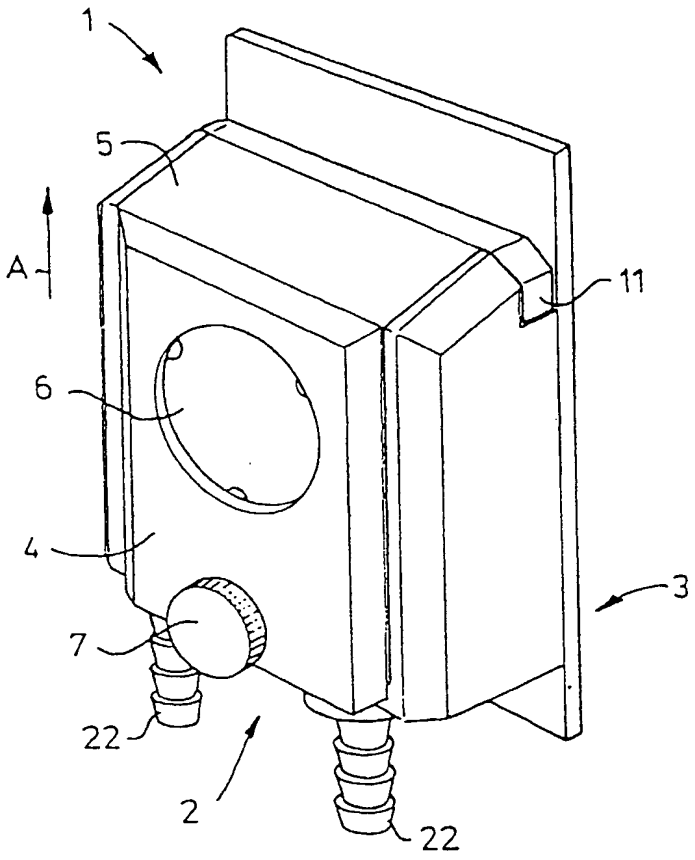

Fig-1

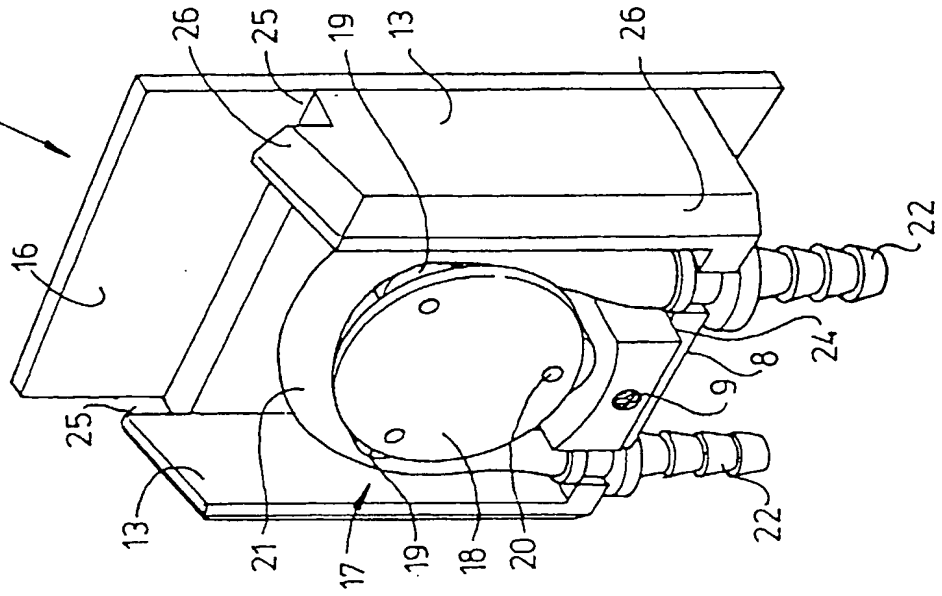
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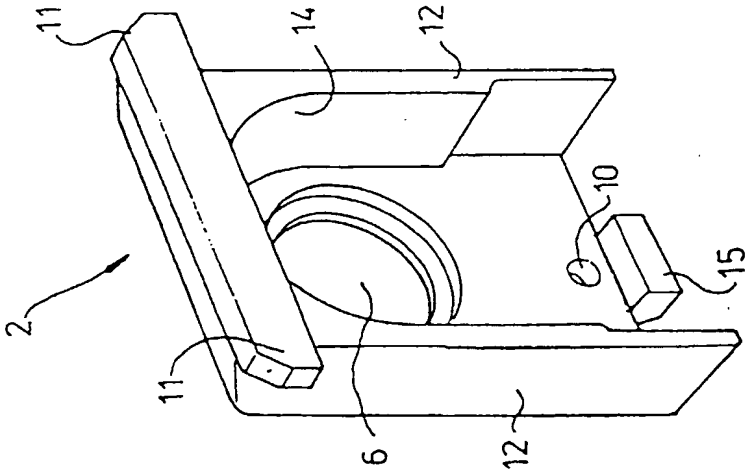
Fig-2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EUROPEAN SEARCH REPORT

Application Number
EP 96 20 0524

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X A	EP-A-0 033 666 (LENTON) 12 August 1981 * abstract; figures * ---	1 2,3	F04B43/12
A	WO-A-93 24755 (ALLERGAN) 9 December 1993 * abstract; figures * ---	1-3	
A	GB-A-2 076 068 (SMITH & NEPHEW) 25 November 1981 * page 3, line 10 - line 33; figures 1-5 * ---	1,7,8	
A	EP-A-0 051 815 (GAMBRO AB) 19 May 1982 * page 4, line 13 - line 15; figures * -----	1,7	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6) F04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10 June 1996	Narminio, A

CATEGORY OF CITED DOCUMENTS

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